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TYPE II PROGRESS REPORT - NUMBER 3

Period: September 7, 1975 to December 7, 1975

EXTENSIVE INVENTORY OF FOREST RESOURCES

BY MULTISTAGE SAMPLING

GSFC Identification Number 2306A

Contract Number S-54053A

Report date - December 10, 1975

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RESOURCES BY MULTISTAGE SAMPLING Progress  
Report, 7 Sep. - 7 Dec. 1975 (Agriculture  
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Extensive Inventory of Forest Resources  
by Multistage Sampling

GSFC Identification Number 2306A

Principal Investigator: Robert C. Aldrich

Coinvestigators: Robert W. Dana  
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STATEMENT OF PROBLEMS:

1. High-altitude color infrared photographs (Mission 75-056A, May 8, 1975) received in August were returned to ASCS, Western Laboratory, Salt Lake City, on August 21. Exposure and color saturation problems were corrected and the photographs returned to Berkeley on October 1. Although the quality of the photographic transparencies made from color internegatives is inferior to direct duplicate transparencies, we have decided to go ahead with our study plan due to time constraints.

2. In our last report (Type II Progress Report - Number 2, September 7, 1975) we stated that we were having a problem hiring a Computer Programmer to continue the computer-assisted classification portions of this study. This problem has been resolved. A programmer has been employed and will report for duty on December 15.

3. We ordered wide band-pass filters to match the LANDSAT-2 spectral bands for delivery in early October 1975. They were not delivered in time for the October 23 field work, however, and old filters with generally wider and longer wavelength bands had to be used. This resulted in more calibration work and greater uncertainty in the measurements of path radiance and beam transmittance.

When the filters were finally delivered, only one set was acceptable--the others had incorrect pass bands. Hopefully the complete filter sets for aircraft and ground instruments will be in hand by January 1, 1976.

ACCOMPLISHMENTS:

Photo Interpretation, Mapping, and Photogrammetry:

1. LANDSAT-2 bulk photographic data were received for scenes 2274-15062 and 2274-15065, October 23, 1975. The data will be combined and enhanced on an I<sup>2</sup>S viewer and color internegatives made for producing both

color transparencies and color prints. We now have excellent data for two seasons--spring (May 14, 1975) and fall (October 23, 1975).

2. We are investigating the possibility of having combined images made for the test site directly from the CCT's. In this way we would avoid resolution losses sustained in going through four generations of photographic products. Both the University of California and Earth Satellite Corporation have this capability and are being considered for this work.

3. County boundary lines within the nine-county area have been transferred by ZTS from 1:250,000 map sheets to prints of the 1:120,000 U-2 color infrared photographs.

4. UTM coordinates of all 472 forest inventory plots are being converted to millimeters and scaled to 1:125,000. These converted coordinates will be plotted on a stabilene base using a coordinatograph and identified by plot number. The plotted locations will be reproduced photographically to overlay a 1:125,000 scale LANDSAT enlargement. This will make it possible to relate LANDSAT spectral data to ground plot data obtained by Forest Survey crews between February and October 1975.

5. All photographic and map preparations should be completed and enhanced color-combined LANDSAT data should be available for our quasi-operational experiment during the next quarter. Unless unforeseen problems arise, we should have all photo interpretation completed by May 1.

#### Computer Analysis, Mapping, and Photogrammetry:

1. During the week of October 20-25, a major portion of the area within the Virginia test site, which had been visited in April, was revisited. This ground work coincided with an October 23, 1975, overpass of LANDSAT-2. Phenological changes in the natural vegetation, the cultural state of agricultural lands and land-use changes were noted. Ground photographs matching those obtained in April were taken at many points to document the temporal changes. Other ground photographs document the general vegetative state for the October scene.

2. The weather on October 23 was exceptionally clear over the entire test site. The clear atmosphere, and the coloration of hardwoods during the height of the fall season, will give us an excellent chance to determine the natural classifications which can be developed in this geographic region from the land cover information derived from LANDSAT-2. We are ordering both imagery and CCT's for the October 23 scenes to use in conjunction with May 14 LANDSAT-2 data in our analysis. Unfortunately, the long delay resulting from the requirement for retrospective ordering of CCT's will mean that there will be much less time available for working with the October 23 scene than is desirable..

3. Work has begun on reading and checking the CCT's for the May 14 LANDSAT-2 scenes 2112-15074 and 2112-15081. With the hiring of a Computer Programmer (effective December 15), computer work should be accelerated during the next quarter.

4. We have been in touch with Maurice I. Stein, NASA/Goddard Space Flight Center, in an attempt to obtain computer programs for the LANDSAT Digital Image Rectification System (DIRS). This system was noted in the LANDSAT Newsletter No. 5, Missions Utilization Office, October 1, 1975. A preliminary documentation of the system has been sent to us, and we hope to receive the full software package for use in our analysis.

5. To learn more about available computer software for LANDSAT utilization, we have tried to contact Bill Alford at the Goddard Program Library. As of this date we have not been able to contact him.

#### Data Standardization and Quantification:

On October 23, 1975, a date for LANDSAT-2 coverage of the Virginia test site, field measurements of solar irradiance and sky radiance were conducted. The instruments were located 3.5 km (2.2 mi.) west of Tappanock, Virginia, near the geographical center of the test area.

Satellite passage was calculated to occur at 10:28 a.m. EDT when the solar altitude was 29.6 degrees. The measurements, covering the solar altitude range of 25 to 40 degrees, were taken during the period of 9:50 a.m. to 12:30 p.m. The weather was clear at this location, and reports indicated cloud-free conditions for the entire test area.

Total irradiance on a leveled diffusing receptor was measured first. Then the receptor was shaded to measure the contribution of sky radiation. The difference between these readings is the direct solar irradiance which is used to compute the beam transmittance.

Sky radiance was measured at a scattering angle equal to the scattering angle experienced by the vertical-viewing LANDSAT sensor. A probe with a field of view of 9 degrees was directed away from the sun at an elevation angle of 90 degrees minus twice the solar altitude. This sky radiance value is used to compute the expected path radiance component of the LANDSAT image.

Measurements were made using wide band-pass filters and more selectively with a circular variable filter (CVF). The CVF measurements were taken at 20 to 40 nm intervals from 400 to 1125 nm with half-bandwidths of 17 to 24 nm.

We intend to compare the wide band measurements with integrations of the spectral CVF data to determine which is more accurate and more efficient for the derivation of solar and atmospheric effects.

#### Aircraft and Ground Data Acquisition:

Ground truth data were collected during the period October 20-25 for both the Computer Analysis and Data Standardization studies (see those sections in this report for details).

#### SIGNIFICANT RESULTS:

There are no significant results to be reported at this time.

#### PUBLICATIONS:

Dana, R. W. 1975. Solar and atmospheric effects on satellite imagery derived from aircraft reflectance measurements. Paper presented at the Tenth International Symposium on Remote Sensing of Environment, University of Michigan, Environmental Research Institute of Michigan, Ann Arbor. October 6-10, 1975.

#### RECOMMENDATIONS:

There are no recommendations to be made at this time.

FUNDS EXPENDED: \$27,982.23

#### DATA USE:

	<u>Value of Data Allowed</u>	<u>Value of Data Ordered</u>	<u>Value of Data Received</u>
ASCS (A/C Imagery)	\$1,500.00	471.00	471.00
ASCS (LANDSAT Imagery)	300.00	238.00	238.00
EDC (CCT's)	2,400.00	800.00	800.00